Declassified in Part - Sanitized Copy Approved for Release 2012/09/04: CIA-RDP78-03424A001400010026-9 DESIGN OF VOICE INTERCONNECTION FACILITIES December, 1955 25X1

Declassified in Part - Sanitized Copy Approved for Release 2012/09/04: CIA-RDP78-03424A001400010026-9

0					7
	1	·	1 1	1	ı

25X1

### DESIGN OF VOICE INTERCONNECTION FACILITIES

The radio portion of this microwave system has been designed to permit a high degree of flexibility in the manner of use of the system. It is desirable that the design of voice interconnection facilities preserve this flexibility and insure insofar as possible that the system initially installed will provide adequately for future improvements and modifications.

With the above objective in mind consideration has been given to the problem of designing a system of voice interconnection facilities which will satisfy initial requirements and at the same time lend itself to the addition of supplemental improvements to meet possible future requirements.

The initial design of voice interconnection circuits has been based upon the assumption that radio circuits will be terminated either in a telephone instrument or in a switchboard, and that initially no requirement will exist for night connection of radio circuits through an unattended board. It is assumed further that when needed ringing will be originated either at a switchboard or at a magneto type of phone. The magneto phone would be required only in those cases in which a radio circuit directly connects two phones without going through a switchboard, in which case it will be necessary for each phone to originate ringing in order to call the other phone.

An earlier memorandum entitled "Plans for Interconnection of Microwave System", dated April 16, 1953, describes an interconnection circuit proposed for use to obtain supervision of radio to radio circuit

DOC 10 REV DATE S 4 80 BY 31/6/ ORIG COMP \$3 OPI \$ TYPE 30 ORIG CLASS PAGES OF REV CLASS U JUST NEXT REV AUTH: HR 76

·25X1-

switchboard connections. The plan is to use this circuit in a manner to be described in more detail in the following paragraphs. Briefly this system of interconnection involves operation with the radio voice channels, that is sub-carrier channels, normally off the air when a circuit is not in use and on when a circuit is in use. The effect of this method of operation is to permit each radio circuit to be interconnected with a wire line in such a way that the radio circuit appears to the wire line exactly as a telephone instrument would were it to be connected in place of the radio circuit. The presence or absence of a received radio signal on a voice channel is used to close or open a switch in the wire line d.c. loop circuit in the same manner that a hook-switch does when a telephone instrument is used. By having the interconnection so arranged, it is possible to obtain supervision on radio to radio circuit connections in the same way that supervision is normally obtained when an extension is used.

The circuit required to accomplish the type of interconnection described above is shown in Fig. 1 attached. It involves the use of a repeat coil, a relay for turning on and off sub-carrier transmitter B+ voltage and a relay operated from the receiver squelch circuit for operating a switch in the d.c. loop circuit. For simplicity, these relays will be referred to hereafter as the B+ relay and the supervisory relay.

In planning the installation of the interconnection facilities of Fig. 1, consideration has been given to the effect which the choice of components will have upon the ease with which improvements may be added in the future. If improvements are visualized for the future consideration



# SECRET

25X1

should be given to them in the choice of components for the initial interconnection facilities and in the layout of components so that the original installation will be compatible with future modifications. The principal effect of improvements considered is to indicate a need for a B+ control relay which has two sets of contacts and is, or can be made to be, of the slow release type rather than a relay having normal action and one set of contacts. Care should also be given initially in the layout of circuits so that space and power provision is readily available when supplemental circuits are added.

The nature of possible future improvements which have been considered will be described below. With them it would be possible to (1) use the presence of a sub-carrier to provide automatic ringing of phones when desired, without the need for transmission of a ringing signal over the radio system, (2) establish night patch connections when desired and (3) to transmit dial tones through the system. These modifications will be discussed in more detail in separate sections which follow. It is emphasized that the circuits described have not been tested and should be before planning for their actual installation goes forward. The purpose for discussing them at this time is to insure insofar as possible that the initial interconnection installation does not rule out or make difficult the addition of such circuits as future improvements should that become desirable.

### Automatic Ringing Facilities:

Automatic ringing as contemplated would provide that where ringing is required it may be obtained at the receiving end of the appropriate

## SECRET

25X1

circuit upon reception of the radio sub-carrier signal. All calls including those requiring ringing would be made in exactly the same way that is, by making a switchboard connection or removing a handset from the hook to turn on the appropriate sub-carrier transmitter. In those cases where a ringing signal is required the actual ringing signal would be originated at the receiving end of the circuit through the use of a special ringing circuit for that purpose.

Figure 2 shows the circuit proposed for obtaining ringing together with a description of this circuit. It is designed to provide that a ringing signal shall be sent over the called party's wire line from the radio voice terminal unit upon the reception of a sub-carrier radio signal. This ringing signal would continue to be sent until the called phone is answered. A provision is also included to prevent ringing back of the called phone if the calling party hangs up before the called party.

The principal purpose of the automatic ringing feature would be to permit a standard procedure for calling on all circuits - that is a procedure which would turn on a voice channel transmitter. This method of ringing would have, in addition, the advantage that no requirement would exist for a phone initiating a call to another phone to be equipped with a facility for generating a ringing signal. As will be described in the following section night patching of circuits will be facilitated since no requirement will exist for ringing through or around circuits patched at a switchboard for unattended operation. Ringing through a switchboard on a radio to radio connection is normally not feasible with the boards planned for use in this system.

SECRET

<sup>-</sup>25X1<sup>-</sup>

### Night Patching:

The switchboards planned for use in this system have no normal provision for night patching trunk to trunk circuits or extension to extension circuits. Since the radio circuits in this system will appear as extensions on the board this means that no provision exists for patching radio circuits through the switchboards at night. The modifications required to the switchboards to do this would be complex.

The most direct method of patching circuits in this system will be at the radio patch boards since both the audio and control circuits will be wired to these facilities as part of the radio installation. This method of patching circuits at night should be employed whenever feasible. However, inasmuch as operational requirements may exist in certain cases for night patching of the circuits at or close to a switchboard, consideration has been given to this problem and the following conclusions reached.

The most straightforward way for patching at or close to a switchboard would be to extend both audio wires and control wires from the radio patch board to a second radio patch board located near the switchboard. Otherwise, a problem arises with respect to night patching of the radio circuits at switchboards because there is no provision in the switchboards for passing signaling information from one extension circuit to another. A talking circuit connection may be made at night in the normal daytime manner and left connected as a night circuit. However, in order to make this circuit useful it is also necessary to provide for transmitting signaling information for ringing and supervisory purposes.

In the daytime when a board is manned the operator manually

### SECDET

<sup>-</sup>25X1

controls ringing. Supervisory lights on the board supply information to the operator which permit manual supervision of the circuit. The problem at night is to transfer the information which is handled by the operator in the daytime from one circuit to another. It has been concluded that the best way to handle this problem would be to use a supplemental patch facility which would either connect only the control functions around the board, as shown in Figure 3 in the case of radio to radio patching or connect both audio and control functions independently of the switchboard for night patching as shown in Figure 4 for radio circuit to radio circuit patching. It is to be noted that with the circuit of Figure 4 it is necessary to provide a battery supply for the night patch facility whereas in the case of Figure 3 the switchboard battery is used.

cuit patching at night. The problem with respect to radio circuit to extension phone patching is similar except that in this latter case there is an additional requirement for providing a ringing signal to signal the extension phone. This signal can be obtained by use of the automatic ringing circuit described earlier in this memorandum. In such a case it would be necessary to modify the proper radio interconnection circuit to provide this function. Since the ringing function is not required for operation into a switchboard but would be required for a night patch through a switchboard to an extension phone, a question arises as to what effect the ringing signal would have upon switchboard circuits if the ringing is not disconnected for daytime use or if a switchboard is used as a part of a nighttime patch (e.g. Figure 3). This problem has not yet been fully re-

### CFODET

-25X1

solved and should be investigated further. If ringing current would in any way damage or deteriorate components in the switchboard an alternative method of operation will have to be found or else a provision included for disconnecting the ringing circuit when the switchboard is in use. One alternative would be to provide that at night line current in the radio d.c. loop circuit will cause ringing current to be supplied to the extension circuit from a sub-cycle ringer until and unless there is line current in the extension phone circuit. This circuit would need a provision to prevent undesired ring-back and could employ the same principle described for use in the case of the automatic ringing circuit.

A third type of circuit for which a night patch requirement may conceivably arise is for connection of a radio circuit with a circuit to a central exchange. This case differs from the radio to extension phone patch in that there would be a need for signaling over the radio circuit from the central exchange trunk by a ringing signal. A circuit for handling this is shown in Figure 5. This same circuit may also be used to connect a radio circuit directly to a Bell system line in place of a telephone instrument if it is desired to provide for calling into and talking over the radio system from a Bell system phone. To permit dialing into the Bell system from the radio system would require further modification as will be described in the following section on dialing facilities.

#### Dial Provisions:

The radio facilities in this system are technically capable of handling dial pulses. In fact some types of voice terminal equipment

## SECRET

CLCLAT	
	25X <sup>2</sup>

equipment in this system while not specifically provided for dialing is adaptable to the transmission of dial pulses with relatively minor modifications to the radio terminal equipment and the addition of relatively simple supplemental facilities to the interconnection facilities. The circuits for this are shown in Figure 6.

25X1

Briefly, the provision for transmission of dial pulses involves the addition of a dial relay in series with a slow release B+ relay shown in Figure 1. This relay would be wired to activate the transmit ring relay in the radio voice terminal unit when in the open position. By having this relay opened momentarily by a dial in the B+ control circuit pulses will be transmitted over the radio circuit. The B+ relay will not be opened by the dial pulses provided it is a slow release relay as indicated in Pigure 1. At the receiving end a second dial relay is needed to open and close the supervisory relay upon reception of dial pulses by the receiver ring relay. This relay is also located in the radio voice terminal unit.

It should be noted that a circuit connected in the above manner to receive dial information cannot receive a ringing signal since the same relay, namely the receiver ring relay, is required to be used in a different manner for each of these functions. It must be determined, therefore, whether dial information or ringing is to be received at a particular receiver voice terminal unit. This decision is necessary only with respect to the receiving location and should not be a difficult decision to make with respect to each circuit since both functions should



Declassified in Part - Sanitized Copy Approved for Release 2012/09/04 : CIA-RDP78-03424A001400010026-9

SEC	ZET
-----	-----

25X1

not be required at the same receiving location.

### Conclusion:

wave system lends itself to considerable flexibility in the manner of use of this communication system. It seems logical that the initial interconnection facilities should be planned to permit expansion and improvement and that this is feasible as described above. It is important that the components used for the circuit of Figure 1 be of the proper type. In particular, the proper type of B+ relay must be used. This should be a slow release relay having two sets of contacts - one needed to provide adequate supervision, the other needed to provide for the automatic ringing circuit when required. It is also important that space provision be made in the initial layout to permit additional components as required.

It should be re-emphasized that the circuits described in this memorandum are new and with the exception of the circuit of Figure 1 have not been tested in practical operating circuits. It is highly desirable that a test program be conducted to insure the workability of these circuits prior to full scale installation. It is felt that the value to be derived from a program of development and test prior to full scale installation will outweigh any delays incurred.

Respectfully submitted.

SEGIP I

December 1953